PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : C02F 1/02, E03C 1/044 — A1

(11) International Publication Number: WO 95/29127

(43) International Publication Date: 2 November 1995 (02.11.95)

(21) International Application Number: PCT/AU94/00206

(22) International Filing Date: 20 April 1994 (20.04.94)

(71) Applicant (*for all designated States except US*): AUSTRALIAN WARM WATER SYSTEMS PTY. LTD. [AU/AU]; 9 Saltash Street, Virginia, QLD 4014 (AU).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): DUNN, William, Alan [AU/AU]; 7 Jackson Street, Clayfield, QLD 4011 (AU). REDMOND, Phillip, Stephen [AU/AU]; 1354 Anzac Avenue, Kallangur, QLD 4503 (AU).

(74) Agent: PIZZEY, John, Kingston; Pizzey & Company, Level 6, Trustee House, 444 Queen Street, Brisbane, QLD 4000 (AU).

(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KG, KP, KR, KZ, LK, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: WATER TREATMENT APPARATUS

(57) Abstract

A water supply apparatus includes a water supply, a plurality of water supply valves fed from the water supply, water heating means for delivering warm water to said supply valves, and treatment means for depathogenizing the supplied water. Preferably, the treatment means treats the supplied water by heating the water to a temperature sufficient and for a time sufficient to pasteurize any undesired pathogenic organisms in the water supplied, and hereinafter generally referred to as pasteurizing. Alternatively, the invention resides in water treatment apparatus including inlet means for receiving water from a water supply, outlet means from which treated water may be delivered, heating means for heating the water received from the inlet means to a temperature at which pathogenic organisms will be destroyed, holding means for delaying passage of the heated water for a time sufficient to ensure eradication of substantially all the pathogenic organisms. Preferably, heat transfer means for dissipating heat from the heated water is included whereby warm water is supplied from the treatment apparatus and the heat dissipation means is associated with the inlet means whereby the dissipated heat is dissipated to the incoming water for preheating the water received from the water supply.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

"WATER TREATMENT APPARATUS"

This invention relates to water supply apparatus.

This invention has particular but not exclusive application to water supply apparatus for delivering warm water at a temperature elevated above ambient but below that which may scald or injure a user, and for illustrative purposes reference will be made to such application. However it is to be understood that this invention could be used in other applications such as for raising the temperature of fluid streams other than water as well as in systems where water is elevated to a temperature above that of the incoming supply.

In applications where warm water is required, a mixing tap is frequently supplied so as to lessen the risk of a user scalding with the high temperature water. In such systems, the preferred water temperature is in the order of 42°C, and this is achieved by mixing the hot water directly from the hot water system with cold water directly from the main or other supply. However, were users may be incapacitated they may accidentally scald themselves by setting the temperature on the mixing tap at too high a level. Additionally, where water at an elevated temperature is transported through pipes or conduits around the building, substantial heat and energy losses are incurred as the heat dissipates from the hot water supply line. Moreover, such water supplies may be contaminated with pathogenic organisms and/or agents.

Complements of thermostatic mixing valves used in hospitals are expensive to install and service and their suitability of use is compounded by the problems associated with Legionella, microbiological analysis, scalding, injury, trade qualifications, etc. Thermostatic mixing valve devices that provide a simple mechanical means to reduce the likelihood of patient scalding, are not only

expensive to install and maintain, but also some recent legislation has rendered them as an inappropriate fitment in health care establishments due to disinfection difficulties.

Furthermore, the cost to replace such thermostatic mixing valves even in relatively small hospitals involves a large capital cost plus ongoing maintenance costs.

The present invention aims to alleviate one or more of the above disadvantages and to provide water supply apparatus which will be reliable and efficient in use.

With the foregoing in view, this invention in one aspect resides broadly in water supply apparatus including:-

a water supply;

a plurality of water supply valves fed from the water supply;

water heating means for delivering warm water to said supply valves, and

treatment means for depathogenizing the supplied water.

The treatment may be by filtration, irradiation or chemical dosing. Preferably however the treatment means treats the supplied water by heating the water to a temperature sufficient and for a time sufficient to kill the undesired pathogenic organisms in the water supplied, and hereinafter generally referred to as pasteurizing. It being understood that such term as used herein includes within its ambit sanitizing, sterilizing, disinfecting, depathogenising and such like.

In another aspect this invention resides broadly in water treatment apparatus including:-

inlet means for receiving water from a water supply;

outlet means from which treated water may be delivered;

heating means for heating the water received from the inlet means to a temperature at which pathogenic organisms will be destroyed;

holding means for delaying passage of the heated water for a time sufficient to ensure eradication of substantially all the pathogenic organisms. Preferably the water treatment means includes heat transfer means for dissipating heat from the heated water whereby warm water is supplied from the treatment apparatus. Suitably the heat dissipation means is associated with the inlet means whereby the dissipated heat is dissipated to the incoming water for preheating the water received from the water supply.

In a further preferred form, the treatment apparatus includes recirculation means for recirculating the warm water which has had heat dissipated therefrom by the heat recovery means.

The holding means is preferably constituted by a holding tank and the volume of the holding tank is such that the time sufficient to pasteurize is at least the quotient of the volume and the maximum incoming flowrate. Suitably, the holding tank is of a volume which permits the heated water to have a residence time of sufficient duration to pasteurize the water when the water is supplied at its full flow rate so that substantially all water supplied through the apparatus is subject to a minimum of 85°C for a minimum of two minutes at full flow capacity. Pasteurized water is cooled by the heat transfer means to an adjustable level nominally set at 42°C and circulated in a closed, pasteurized environment.

In a preferred embodiment, the water is heated by a gas fired heater adapted to be substantially unattended and designed to provide a continuous supply of pasteurized, controlled temperature warm water for ablution purposes. Preferably, the gas fired heater is adapted for burning liquid petroleum gas, town gas, natural gas and such like, although other forms of energy may be used such as electricity, coal, solar power and such like

In a further preferred embodiment, the apparatus includes bypass means for bypassing the heat recovery means whereby the water treatment apparatus downstream from the heat recovery apparatus may be pasteurized by feeding warm water directly from the heating means through the warm water delivery system.

Suitably, the system pasteurization is provided by subjecting the circuit to a recirculating stream of heated water at a minimum of 85°C for a minimum time of three minutes at every point in the reticulation circuit. System pasteurization typically would take place upon installation, commissioning and subsequently as often as required by monitoring and measurement of microorganism buildup in the system reticulation.

In another aspect, this invention resides broadly in a method of providing pasteurized warm water, the method including:-

providing continuous water heating means;

heating the water to a temperature which will pasteurize the water;

maintaining the water temperature for a time sufficient to pasteurize the water;

cooling the pasteurized water, and

delivering the cooled pasteurized water.

Preferably the method includes delivering the cooled water at a temperature elevated above ambient but below that which may scald, injure or cause discomfort to a user. It is also preferred that the method includes the cooling of the pasteurized water be used to pre-heat the water received from the water supply.

Typically, the organisms targeted for pasteurization are those specified in the Code of Practice for the Control of Legionnaires' Disease, NSW Health Department, Publication No. SWRO 91-08 and suitably, sample collection, test

procedures and test specifications are preferably followed as set out therein.

Suitably, the system includes fail-safe controls, computerised monitoring and alarm systems and is preferably energy-efficient.

In order that this invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and where:

FIGS. 1 and 2 are schematic representations of a warm water apparatus.

Referring to FIG. 1, a warm water apparatus 10 includes a supply valve 19 for receiving water from a water supply 21 such as a municipal mains water supply. The volume of water coming through the water supply 21 is metered by a water meter 22. The water then passes through a supply line 23 from the water meter 22 to a three-way valve 3. The three-way valve 3 may be actuated to direct the incoming water to either a preheat line 24 or a by-pass line 25 through a by-pass check valve 5.

The pre-heat line 24 passes through a second heat exchanger 18 and then joins the by-pass line 25 and passes through a gas fired water heater 26 and then through a hot water line 27 to a holding tank 16. The hot water from the holding tank 16 then passes through a delivery line 28 through a check valve 7, a first heat exchanger 17, a ball valve 12, and a check valve 13a. The hot water then passes through the second heat exchanger 18 whereupon it is substantially cooled to an operating temperature as desired for example 42°C.

The warm water exiting the second heat exchanger 18 then passes through a warm water loop line 29 and through a pump 30. The warm water loop line 29 is also provided with drain valves 2 and 14. The warm water recirculating through the warm water loop line 29 recirculates through a

check valve 13b and through the second heat exchanger 18 in a continuous loop. Warm water may be drawn from the warm water loop line 29 through warm water outlets 34.

Hot water from the holding tank 16 may also be used to pasteurize the system by opening a ball valve 6 on a pasteurizing line 31 to permit hot water to pass through the pump 30. For the recirculation of the hot water, a ball valve 11 is opened on a pasteurizing take-off line 32 so that hot water passes through the ball valve 11, a check valve 20, a ball valve 9, a bleed pump 33, a check vale 8, a ball valve 15, the first heat exchanger 17, the ball valve 12, and the check valve 13a, to join with the hot water being recirculated through the warm water loop line 29 through the second heat exchanger 18 and the check valve 13b.

Thus, it will be seen from the above that hot water will be recirculated by this arrangement through the pasteurizing line 31 and the warm water loop line 29 together with all associated lines and equipment downstream from the first heat exchanger 17. It will also be seen that all equipment upstream of the first heat exchanger 17 and downstream from the water heater 26 would be at the temperature of the pasteurizing water provided from the holding tank 16 during the pasteurizing operation. Other valves and drain lines such as a drain valve 4 and ball valves 6a and 6b are provided as appropriate for the operation of the system for the warm water apparatus 10.

In use, the apparatus includes such fail-safe devices as for example full flow, continuous, over-temperature monitoring of warm water outlet with automatic shut-off and alarm of warm water supply; continuous flame-failure monitoring with automatic gas shut-off and alarm; continuous over-temperature monitoring of high temperature circuit with cut-out; provision for redundant monitors and alternate heat supply and such like.

In a typical example, the capacity of the holding tank which would provide a 20°C rise above supply water temperature would be 600 L/hr; 1600 L/hr; 3600 L/hr or 5000 L/hr or a multiplicity and/or combination of these for capacities larger than the standard range. Since the jacket water is open to atmospheric pressure it is believed that the apparatus would not require boiler certification or specially trained staff.

Cleaning may be provided by standard CIP design including providing the holding tank with convex ends and no exposed ridges is designed to facilitate cleaning and flushing under operational conditions. High capacity circulating pumps ensure continuous scouring of reticulation system thus preventing buildup of sediment.

In use, cold (raw supply) water enters at the bottom through a fine in-line filter to remove coarse impurities direct to the motorised 3-way valve 3. This 3-way valve is controlled by a programmable logic controller or the like taking its control parameters from a fast reacting temperature monitor in the warm water output of the heat exchanger. This warm water is pumped around the building through a recirculating reticulation loop ready for draw-off use at outlets; unused warm water in the loop is returned to the inlet side of the heat exchanger.

The 3-way valve 3 may be set to shunt supply water either through the heat absorption side of the heat exchanger (to the input of the warm water apparatus of this invention if the warm water output is too hot, or directly to the warm water apparatus and not through the heat exchanger if the warm water output is too cold. This raw water supply shunting is continuously variable.

The water entering the warm water apparatus of this invention is rapidly raised in temperature to a minimum of 85°C but not above 99°C and is then transferred to the top of the pasteurization holding tank 16, designed such that

it permits a slow migration of the hot water therethrough whereby a minimum of two minutes residence time is provided before the high temperature water exits near the bottom of the tank. Such residence time is believed to be sufficient for all targeted microorganisms to be destroyed and the water is supplied direct to the warm water loop through the first heat exchanger 17 prior to entering the inlet of the second heat exchanger 18.

Reverse flow is prevented in the warm water loop thus forcing the high temperature water to flow through the second heat exchanger. The holding tank has a settlement space and bottom drain-flush capability to ensure accumulated dead organisms and other contaminants can be regularly discharged by a blow-down procedure or such like.

As the pasteurized warm water is consumed from the loop at showers and other outlet faucets it is replaced by pasteurized high temperature hot water from the holding tank, mixing with the returning previously pasteurized water from the warm water loop and raising its temperature in direct proportion to the rate of use. This increase in water temperature is cooled by the second heat exchanger to the required 42°C and pumped out to the loop.

The warm water output of the second heat exchanger has minor temperature variations of approximately +4, -2°C immediately at the output under variations in draw. These temperature variations are dampened out by thermal capacity in the warm water reticulation loop to within approximately 1°C of the set temperature for the warm water.

The continuously variable output gas burner heating the warm water apparatus is preferably controlled by a PID controller to ensure burner control matches output requirements. The PID controller may be computerized and/or computer supervised. The burner is fitted with purge control facilities, flame-failure monitoring/shut-down and gas shut down facilities.

A fail-safe motorised shut-off valve 1 is provided in the warm water outlet of the heat exchanger and is set to shut-off the warm water supply to the loop if the warm water temperature exceeds 46°C.

The bleed pump circuit shown provides automatic temperature maintenance of the warm water loop. During long periods of nil consumption at outlets, incoming "hot" water to the loop ceases; thus the warm water in the loop can gradually cool down due to thermal conduction and radiation losses. A monitoring system activates the solenoid valve and the bleed pump 33 if the temperature of the warm water loop is lower than 40°C, quickly returning the loop temperature to 42°C.

The valving arrangement of ball valves 6 & 12 with safety interlocks provide initial commissioning pasteurization and subsequent pasteurization procedures. During the pasteurization procedure hot water at a temperature of 85°C minimum is taken directly from the holding tank 16 to the warm water loop and circulated continuously through every part of the loop at this high temperature whilst each outlet has high temperature water drained through it for a minimum of three minutes. The temperature at each outlet is monitored during pasteurization to ensure the temperature does not drop below 85°C.

During the pasteurization process the second heat exchanger is prevented from receiving cold water to the heat absorption side. Additionally, the warm water flow second heat exchanger passages are part of the pasteurized system.

After pasteurization, the pasteurization bypass valve 6 is closed, the outlet valve of the first heat exchanger is opened and the system loop is drained of hot water. The system is then returned to an operational, pasteurized warm water system. During draining, all replacement warm water

is fully pasteurized as it passes through the holding tank. Thus, the hot water used to pasteurize the apparatus is chased out by warm water when the apparatus is being returned to its operational mode.

Not shown in FIG. 1 are optional back-up facilities and temperature monitoring and control devices available such as may be provided for example by a computer based building management system or the like that may be used to provide intelligent alarm, control, consumption, demand rates and remote monitoring. Such facilities are not an absolute necessity in the system as the warm water apparatus and all control, monitoring and safety circuits are in the preferred embodiment included so that the system is a stand-alone unit, however, it is believed that the addition of building management systems facilities provides a method of management, control, alarm, and associated monitoring strategies plus additional backup safety features.

In a preferred form, the warm water apparatus is capable of supplying fully pasteurized water at a temperature of 42°C over range of from zero litres/hour to in excess of 5000 litres/hour.

The problems that prevented the success of early efforts appeared to be capable of being "designed-out" and were considered to be targets well within current engineering knowledge, capability and practice.

Whilst not relying on theory or limiting the scope of this invention thereto, it is believed that a warm water apparatus of this invention satisfies such design criteria as being capable of pasteurization of water to a total plate count of less than 100 CFU/mL; capable of pasteurization of water for species Legionella pneumophila serogroup 1-14 to a level of less than 10 CFU/mL; capable of pasteurization of Legionella pneumophila (total) to a level of less than 10 CFU/mL; capable of pasteurization of water for faecal coliforms to a level of less than 1

CFU/100 mL; supply a constant adjustable source of continuously pasteurized warm water at approximately 42°C with fail safe devices, alarm warning and automatic operation; be capable of easy initial pasteurization and easy in-field pasteurization procedures if the supply becomes re-infected; meet public health regulations; be capable of flush-cleaning of storage tanks. No possibility of sediment accumulation in tanks and minimised sediment accumulation in reticulation system components; have the capability of rapid temperature rise, and able to reach temperatures above 85°C to ensure destruction of opportunistic bacteria.

Commercial heat exchangers are available in small, compact units. Various manufacturers can supply them "off-the-shelf" complete with technical design specifications. For unusual designs manufacturers can supply computer generated design specifications and customized exchangers to the users requirements. These units are built up from modular components. Typically, plate heat exchangers are preferred.

The total process of pasteurizing ablution water provided by this invention is believed to be a low energy system process due to the heat reclaiming function of the heat exchanger wherein only raw supply water is heated from about 18°C to 42°C, being a modest temperature rise in the order of 24 degrees in most applications.

Temperature monitoring and temperature control of the pasteurized warm water circuit may take place with a microprocessor controlled PID controller, building management system, programmable logic controller, or such like and the control of this temperature nominally set at 42°C at the output is substantially maintained regardless of temperature variations or flow rates. The control system used preferably includes predictive characteristics

and/or other control parameters that result in little overshoot.

It will of course be realised that while the above has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as is claimed in the following claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Water treatment apparatus including:-
inlet means for receiving water from a water supply;
outlet means from which treated water may be delivered;
heating means for heating the water received from the inlet means to a temperature at which pathogenic organisms will be destroyed, and
holding means for delaying passage of the heated water for a time sufficient to ensure eradication of substantially all the pathogenic organisms.

2. Water treatment apparatus as claimed in claim 1, including heat transfer means for dissipating heat from the heated water whereby warm water is supplied from the treatment apparatus.

3. Water treatment apparatus as claimed in claim 2, wherein sufficient heat is dissipated whereby warm water is supplied at a temperature above ambient but below that which may scald a user.

4. Water treatment apparatus as claimed in claim 2, wherein said heat transfer means is in heat exchange relationship with said inlet means.

5. Water treatment apparatus as claimed in any one of the preceding claims, wherein said holding means is constituted by a holding tank having a volume which permits the heated water therein to have a residence time of sufficient duration to pasteurize the water received from a water supply.

6. Water treatment apparatus as claimed in any one of the

preceding claims, wherein substantially all water supplied through the apparatus is subject to a minimum of 85°C for a minimum of two minutes.

7. Water supply apparatus including:-

a water supply;

a plurality of water supply valves fed from the water supply;

water heating means for delivering warm water to said supply valves, and

treatment means for depathogenizing the supplied water.

8. Water supply apparatus as claimed in clam 7, wherein said treatment means is able to heat and maintain water supplied thereto at a temperature for a sufficient duration to depathogenize the supplied water.

9. Water supply apparatus as claimed in claim 8, wherein said treatment means is water treatment apparatus as claimed in any one of claims 1 to 6.

10. Water supply apparatus as claimed in claim 9, wherein warm water is supplied to said plurality of water supply valves at a temperature of between 40°C and 45°C.

11. Water supply apparatus as claimed in claim 10, wherein said water treatment apparatus includes bypass means for bypassing said heat recovery means.

12. A method of pasteurizing water supply apparatus as claimed in any one of claims 7 to 11, including subjecting the apparatus to a recirculating stream of heated water at a minimum of 85°C for a minimum time of three minutes.

13. A method of providing pasteurized warm water, the method including:-

providing continuous water heating means;

heating the water to a temperature which will pasteurize the water;

maintaining the water temperature for a time sufficient to pasteurize the water;

cooling the pasteurized water, and

delivering the cooled pasteurized water.

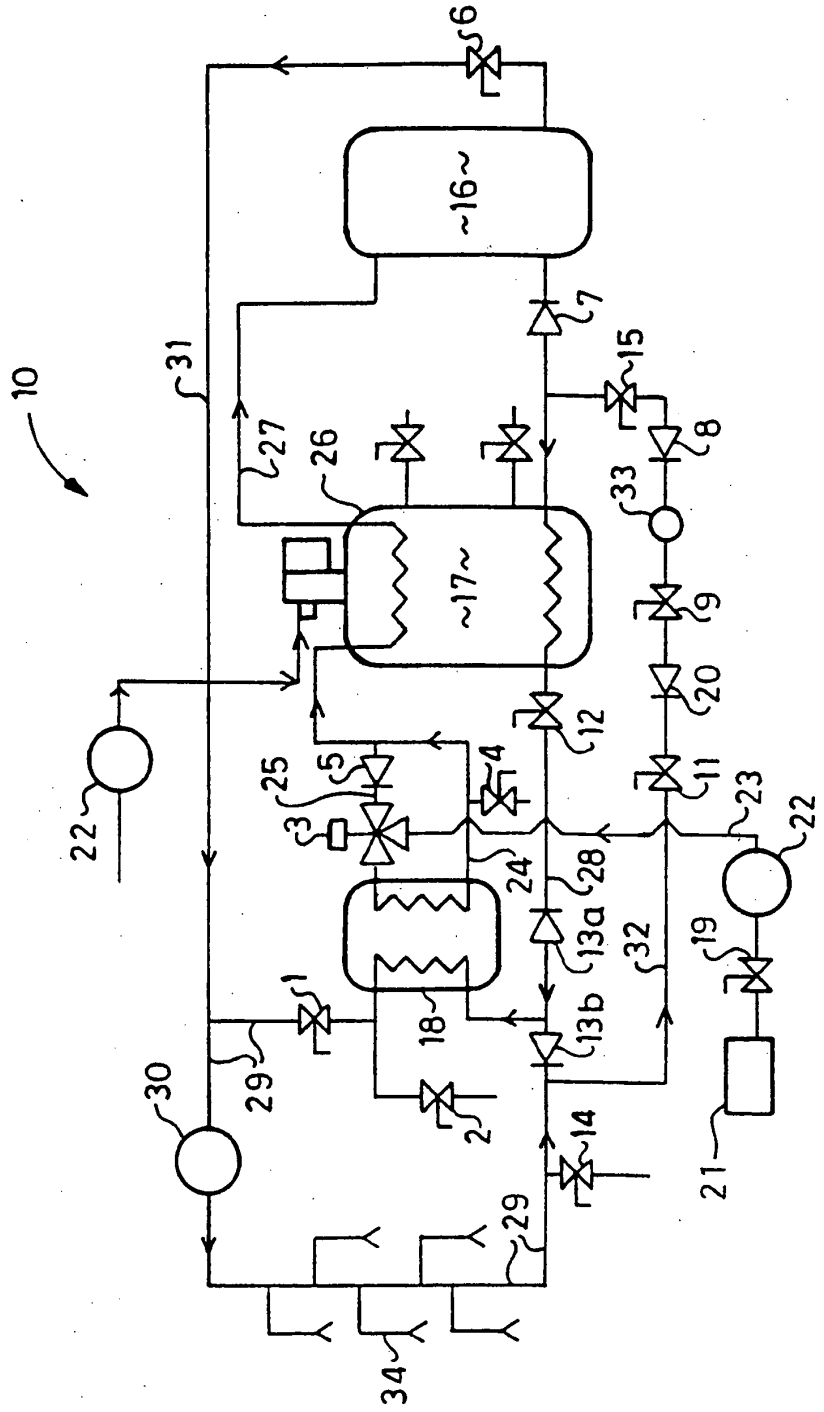
10
~16~
~17~
1
2
3
4
5
6
7
8
9
11
12
13a
13b
14
15
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

FIG. 1

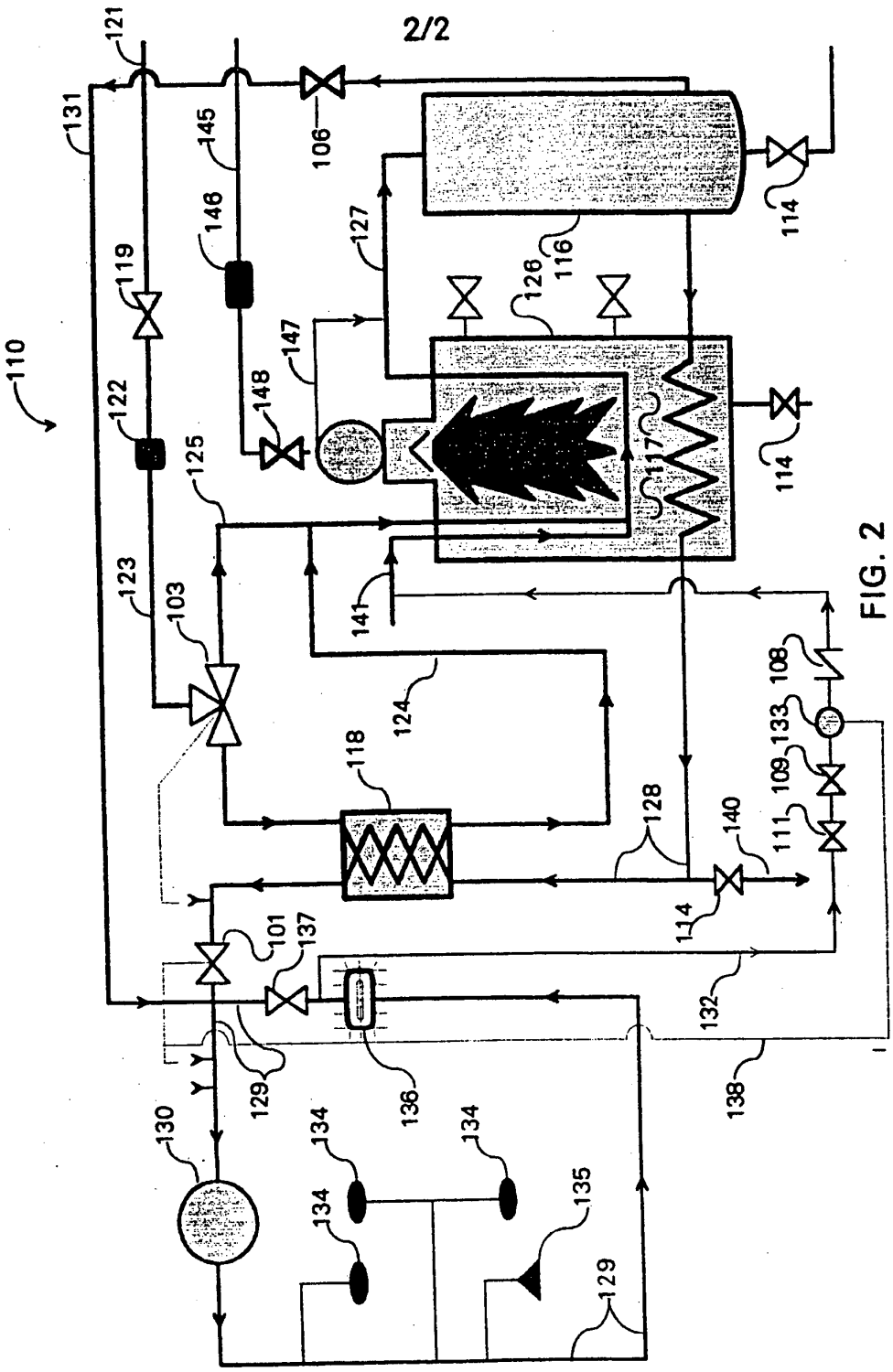
110
101
103
106
108
109
111
114
116
117
118
119
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
140
141
145
146
147
148

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No:
PCT/AU 94/00206

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[5] C02F 1/02, E03C 1/044

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC C02F 1/02, C02B 1/02, E03C 1/04, E03C 1/044

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC C02F 1/02, E03C 1/044

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
See Extra Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	GB,A,2230256 (BEAUMONT) 17 October 1990 (17.10.90) Whole document	1-5, 7-9, 13
X	EP,A,183968 (TOSHIBA) 11 JUNE 1986 (11.06.86) page 3, lines 16-37, page 5, lines 19-26, Figures	1-3, 7-13
X	AU,A,61814/90 (NICHOLAS) 7 March 1991 (07.03.91) page 5, line 8 - page 7, line 29	1, 5, 6, 9, 12, 13
X	AU,A,42259/89 (BEAUMONT) 22 March 1990 (22.03.90) page 5, line 11 - page 6, line 14	1, 4-9, 11-13

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 1994 (20.06.94)	30 June 1994 (30.06.94)

Name and mailing address of the ISA/AU

AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION
PO BOX 200
WODEN ACT 2606
AUSTRALIA

Facsimile No. 06 2853929

Authorized officer

M. BREMERS

Telephone No. (06) 2832052

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00206

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
E, X	AU,A,,49147/93 (AUST. WARM WATER) 5 May 1994 (05.05.94) Whole documnet	1-13
X	GB,A,748407 (CHAS. F. THACKRAY) 2 May 1956 (02.05.56) Whole document	1-13
X	Derwent Abstract Accession No. 90-287645/38, claiss D15, JP,A,02-203982 (NIPPON SANSO) 13 August 1990 (13.08.90) abstract	1, 6
X	FR,A,2583035 (ODENWALDWERKE) 12 December 1986 (12.12.86) Abstract, page 4 line 24 - page 5 line 25	1-13
X	DE,A,3525990 (BUDERUS) 29 January 1987 (29.01.87) Whole document	1-13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00206

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
FR 2583035	DE 3618186
AU 42259/89	WO 9002707
EP 183968	JP 61103592 US 4664793
AU 61814/90	WO 9102935

END OF ANNEX

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00206

Box I **Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This international search report has not established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II **Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-6, 8-13 define water treatment apparatus or method in which water is heated and maintained at a temperature which kills any pathogens. Claim 7 defines an apparatus for depathogenizing warm water. It is not restricted to depathogenizing by heat. The feature common to all claims (depathogenization of water) is not considerd to be a spcial technical feature within the meaning of PCT Rule 13.2 since it makes no contribution over the prior art.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically

claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

(continuation)

KEYWORDS

KW1 - PASTEUR: OR DISINFECT: OR PATHOGEN OR DEPATHOGEN: OR ORGANISM# OR BACTERI: OR MICROBIOLOG: OR BIOLOG:

KW2 - HEAT: OR BIOL: OR COOL:

KW3 - H20 OR AQUE: OR AQUA: OR WATER

KW4 - HOLD OR MAINTAIN OR DELAY OR RESIDENCE OR MAINTEN:

DATABASES

(a) DERWENT, JAPATIC

C02F 1/02 AND KW1

C02B 1/02 AND KW1

E03C 1/04 AND KW2

(b) CHEMICAL ABSTRACTS

1989-1994 AND KW1 AND KW2 AND KW3 AND KW4.